



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE GROWTH OF ST. LOUIS CHILDREN.

BY WILLIAM TOWNSEND PORTER.

In January, February, and March, 1892, 33,500 boys and girls in the St. Louis public schools were measured by me and my assistants. The following data were collected: Name of pupil, place of birth, age at nearest birthday, birthplace of father, birthplace of mother, occupation of father, number of brothers and sisters living and dead, residence of pupil, color of hair and eyes, height standing, height sitting, span of arms, strength of squeeze with right and left hand, girth of chest at full inspiration and full expiration, weight, acuteness of vision in right and left eyes, length of head, width of head, height of face from root of nose to point of chin, width of face, height of face from hair line to point of chin, and, finally, the school grade of the pupil.

The information thus secured has furnished material for the following publications: (1) *The Physical Basis of Precocity and Dullness*, Transactions of the Academy of Science of St. Louis, Vol. VI, No. 7, issued March 21, 1893; (2) *The Relation between the Growth of Children and their Deviation from the Physical Type of their Sex and Age*, Transactions of the Academy of Science of St. Louis, Vol. VI, No. 10, issued November 14, 1893; (3) *Untersuchungen der Schulkinder in Bezug auf die physischen Grundlagen ihrer geistigen Entwicklung*, Verhandlungen der Berliner Anthropologischen Gesellschaft, Sitzung vom 15 Juli, 1893, Virchow's Zeitschrift für Ethnologie; (4) *The Growth of St. Louis Children*, Transactions of the Academy of Science of St. Louis, Vol. VI, No. 12, issued April 14, 1894. Three other papers are in preparation: *The Growth of Large and Small Children*; *Acuteness of Vision in the St. Louis Public Schools*; and a statement of the normal weights for children of different heights.

I purpose in this paper to give a brief account of some of the results of these studies.

It is a matter of much interest to determine whether measurements made for the most part by teachers in the public schools are sufficiently accurate to furnish reliable physical standards. The statistician answers this question by comparing the observed distribution of the heights or weights, etc., at any age with the distribution of an equal number of observations according to the theory of probabilities. A glance at the theoretical and the observed distribution of the heights of 2192 girls, aged 8 (Table No. 7 in *The Growth of St. Louis Children*), shows a satisfactory agreement between them. This indicates that the number of measurements is so large that deviations to one side of the true height are fairly well compensated by deviations to the other side. In such a case the median value of the series is typical of the series. Thus, in this investigation measurements collected by comparatively unskilled observers were found to satisfy the requirements of theory.

The objection sometimes made that the errors of observation materially affect the truth of the values obtained is of little weight, partly because such errors are "accidental" and compensate each other, and partly because a deviation from the middle value due to an uncompensated error in measurement forms, as a rule, an inconsiderable part of that greater deviation which expresses the physiological difference between the individual and the type of his age and class. "Accidental" errors of observation need not give concern in measurements of great numbers of school children. Nor need there be much fear of constant errors of observation, provided the collection of material is made by many persons, and with a good number of each sort of measuring instrument.

The degree of deviation of individual measurements from the median value of an anthropometrical series is measured by the Probable Deviation, that value which, in the words of Lexis, is as often exceeded as attained. Hence, if Quetelet's

theory is true, the probable deviation is a measure of the degree of deviation of individuals from their physical type. The probable deviation contains the Error of Observation as well as the Physiological Difference of the individual from the type. The Error of Observation, in a large series of measurements, is insignificant. The probable deviation may therefore, without any error of importance, be considered as the physiological difference between the individual and the type.

The comparison of the probable deviations from the average height standing of the school children in the Freiburg School District (measured by Geissler and Uhlitzsch) and the St. Louis school children reveals a difference of only a few millimetres, although St. Louis children are taller than Freiburg children. It follows that the physiological difference between individual school children and the physical type of their sex and age is essentially the same where the differences between the children compared are not greater than those existing between the St. Louis and the Freiburg children.

The probable deviation at different ages is found to vary with the quickness of growth as measured by the relative annual increase of average height, weight, etc. Hence, the physiological difference between the individual children in an anthropometrical series and the physical type of the series is directly related to the quickness of growth.

It is much disputed whether median or average (arithmetical mean) should be employed as the type value. The difference between the median and the average values in this investigation is relatively small, indicating that the median value, which is obtained with comparatively little labor, may be used in place of the average, where the material is as large, and of the same nature, as that analyzed by me.

It is pointed out that the comparisons now often made between the type-children of the schools of different cities and countries cannot be justified, unless it is shown that the school populations from which these types are drawn are

sufficiently alike to be rightly comparable. Information is given concerning occupation of parents of St. Louis children.

A comparison of the weights of the daughters of manual tradesmen with the weights of the daughters of professional men and merchants teaches that the latter are very little heavier than the daughters of manual tradesmen until the period of prepubertal acceleration; and that the weight of girls is much more influenced by the material prosperity, or social status, of parents during and immediately after the period of prepubertal acceleration than in the earlier years of growth.

The nationality of the children should be considered in an anthropometrical enquiry. The weights of children of German parentage are compared with those of American parentage. The difference between the two is inconsiderable.

When the curves of growth in weight, height standing, height sitting, span of arms, and girth of chest are drawn on the same system of co-ordinates, the attention of the observer is arrested by the difference in the development of girls and boys during the period of prepubertal acceleration. Girls enter this time of rapid growth at age 11 or 12, two years earlier than boys, and during several years are larger than boys of the same age. The ages at which girls begin to be larger than boys are nearly the same in all five dimensions named above, and a similar correspondence is seen in the age at which girls cease to be larger than boys. The sexual difference just noted is not present in expansion of chest, or in strength of squeeze, or in any head or face measurement, except height of face from hair-line to point of chin. Boys have therefore a larger expansion of the chest, greater strength of squeeze, and greater length and width of head, and height and width of face than girls throughout their period of growth.

The duration of the period during which girls are larger than boys in weight, height standing, height sitting, span of arms, and girth of chest is shortest in span of arms, and is

considerably longer in height sitting than in any other dimension.

Big girls begin to be larger than big boys at an earlier age than that at which small girls begin to exceed small boys. The period in which small girls are larger than small boys is longer than that in which big girls are larger than big boys.

The absolute annual increase of height standing, weight, span of arms, height sitting, girth of chest, and strength of squeeze is greatest in girls at age 13, and in boys at age 15, nearest birthday. The relative annual increase (increase at any year divided by the average value at that year) gives a truer idea of growth than the absolute annual increase, because the latter value is entangled with the size of the individual measured. The absolute increase is commonly greater in a big boy than in a small boy, and yet the rate of growth may be the same. The relative annual increase is free of such errors. The relative annual increase in strength of squeeze, weight, height standing, height sitting, span of arms, and girth of chest is treated in Chapter VII of *The Growth of St. Louis Children*.

The ratio of span of arms, height sitting, chest girth, weight, strength of squeeze with right hand, and five head and face measurements to height standing is also given in Chapter VII. These relations are shown graphically in Plate XLV of *Growth of St. Louis Children*, height standing being expressed by an abscissa, and the percentage relation of the other dimensions to height displayed in curves. Of all these span of arms most closely approximates the height, the difference being less than one per cent of the latter from age 6 to 11, and scarcely more than two per cent in subsequent ages. The height sitting and the girth of chest run a parallel course, and are, moreover, nearly equal, the girth of chest being about two per cent less than the height sitting. They increase a little less rapidly than the height, showing a decline of about 4 per cent in thirteen years. Height sitting and chest girth are not far from half the height standing.

Far different is the development of weight and strength of squeeze. These increase much more rapidly than height, for at age 6 the height stands to weight in the ratio of 100 to 18, and to strength of squeeze as 100 to 6, while at age 16 these ratios are 100 to 34 and 100 to about 16, respectively. The parallelism in the development of weight and strength of squeeze is interesting. The dimensions of the head and face increase somewhat less rapidly than the height.

In Volume VI, No. 7, of the *Transactions of the Academy of Science of St. Louis*, issued March 21, 1893, I demonstrated that children who possess more than the ordinary power of mental labor, as measured by their progress in their studies, are heavier, taller, and larger in girth of chest and in width of head than their less gifted companions of the same age. A more extended statement of these observations was presented to the Berliner Gesellschaft für Anthropologie, Ethnologie, und Urgeschichte, July 15, 1893, and appears in *Virchow's Zeitschrift für Ethnologie*, under the title "Untersuchungen der Schulkinder in Bezug auf die physischen Grundlagen ihrer geistigen Entwicklung." In these papers the material was the total number of observations irrespective of the social condition of parents. An example, selected from Tables Nos. 2 and 4, pages 165 and 167, of *The Physical Basis of Precocity and Dullness*, will illustrate the result of the enquiry. Pupils aged 11 are found in Grades I, II, III, IV, V, and VI of the St. Louis Public Schools, as the following table shows. The 59 boys of Grade I, the lowest grade,

TABLE SHOWING MEDIAN WEIGHT OF BOYS AGED 11 DISTRIBUTED BY SCHOOL GRADE.

Grades.	Number of Boys Weighed.	Median Weight. Kilogrammes.
I	59	28.83
II	311	29.74
III	664	30.92
IV	546	31.43
V	123	32.41
VI	33	33.29

weigh less than the boys of Grade II, and these again are lighter than the boys in higher grades.

When children of the same age and, nearly as possible, of the same class of society are weighed, and the weights distributed by school grade, it is found that they follow the law established for the whole material irrespective of social condition. Tables are given in *Growth of St. Louis Children* of the weights of the daughters of manual tradesmen and of the daughters of professional men, distributed by school grade. The results of this study of the weights of girls from the same social class confirm the conclusion that successful pupils are larger than the unsuccessful.

The relation between the ability to succeed in school work and the rate of growth or yearly increase in size is treated in *The Physical Basis of Precocity and Dullness*, p. 176 *et seq.* It appears that the comparative rate of growth of dull, mediocre, and precocious children of the same sex is the same at all ages, from 7 to 16, inclusive. The data at hand were not sufficient to decide whether this law is true of other ages in the period of growth. It is further shown that the acceleration in weight preceding puberty takes place at the same age in dull, mediocre, and precocious children; and that the point in the period of accelerated development at which girls become heavier than boys is the same in the dull, the mediocre, and the precocious.

The following are among the data given in *Growth of St. Louis Children*: The median and average value of each series of observations; the probable deviation; the probable error of the average; median minus average value; relation of weight, span of arms, etc., etc., to height standing; the 5, 10, 20, 25, 30, 40, 50, 60, 70, 75, 80, 90, and 95 percentile grades; the absolute annual increase of the average; the absolute annual increase at various percentile grades; the relative annual increase; and several cranial indices.